Space Weather Technical Forecast

Issued on Wednesday, 21 February 2024 at 01:17 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Ongoing chance of Moderate activity.
Solar Activity: Solar activity has been Low throughout with only mid-range C-class flares observed from the vicinity of AR3590, which is a large and increasingly complex region in the far northeast quadrant. This is one of four sunspot regions on the visible disc, with the remaining regions all stable or weak, with no significant evolution observed. Ex-AR3576 has rotated beyond the western horizon, but still presents a decreasing flare risk.

No Earth-directed CMEs have been observed in the last 24 hours.

Solar Wind / Geomagnetic Activity: Solar winds, as observed at L1 by ACE, has been at ambient levels throughout the period, with density below average. Total magnetic field strength started weak, but gradually increased to moderate levels from around 20/0915UTC, reaching 9nT by the end of the period. The source of this increase is uncertain, but could be due to perturbations induced in the magnetic field due to a glancing CME. The north-south component was mainly weakly negative until 20/2015UTC, with a negative peak of -8nT at 20/1851UTC. Phi angle was mainly positive (away from the Sun), but with two periods of negative between 20/0600-20/0900UTC and briefly around 20/1120UTC. Geomagnetic activity was mainly Quiet, with one Unsettled interval at the end of the period.

Energetic Particles / Solar Radiation: GOES18 high energy (greater than 10MeV) proton flux was just above normal background levels but on a slowly declining trend. Electron flux (greater than 2MeV), observed at GOES16 has been at normal background levels, with electron fluence well below the Active (1e8 integrated pfu) threshold. The observed 24-hour fluence at 21/0001UTC was 1.06e6 integrated pfu.

Four-Day Space Weather Forecast Summary
Solar Activity: Low activity is forecast, but with a risk of Moderate activity from AR3590 and a decreasing risk from ex-AR3576 which is just beyond the western limb.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs are forecast. Solar wind speeds are forecast to remain at ambient levels, but may reach between 400-500km/s due to the forecast onset of a high speed stream from coronal hole 01. Geomagnetic activity is forecast to be mainly Quiet to Unsettled, with a slight chance of Active intervals due to the onset of the high speed stream on 24 February.

Energetic Particles / Solar Radiation: GOES18 high energy (greater than 10MeV) proton flux will continue to gradually ease to background. Ex-AR3576 presents a decreasing risk, with AR3590 considered too far east to provide significant proton enhancements.

High energy electron flux (greater than 2MeV) is expected to remain at normal background levels. 24-hour electron fluence is expected to stay below the Active (1e8 integrated pfu) threshold.

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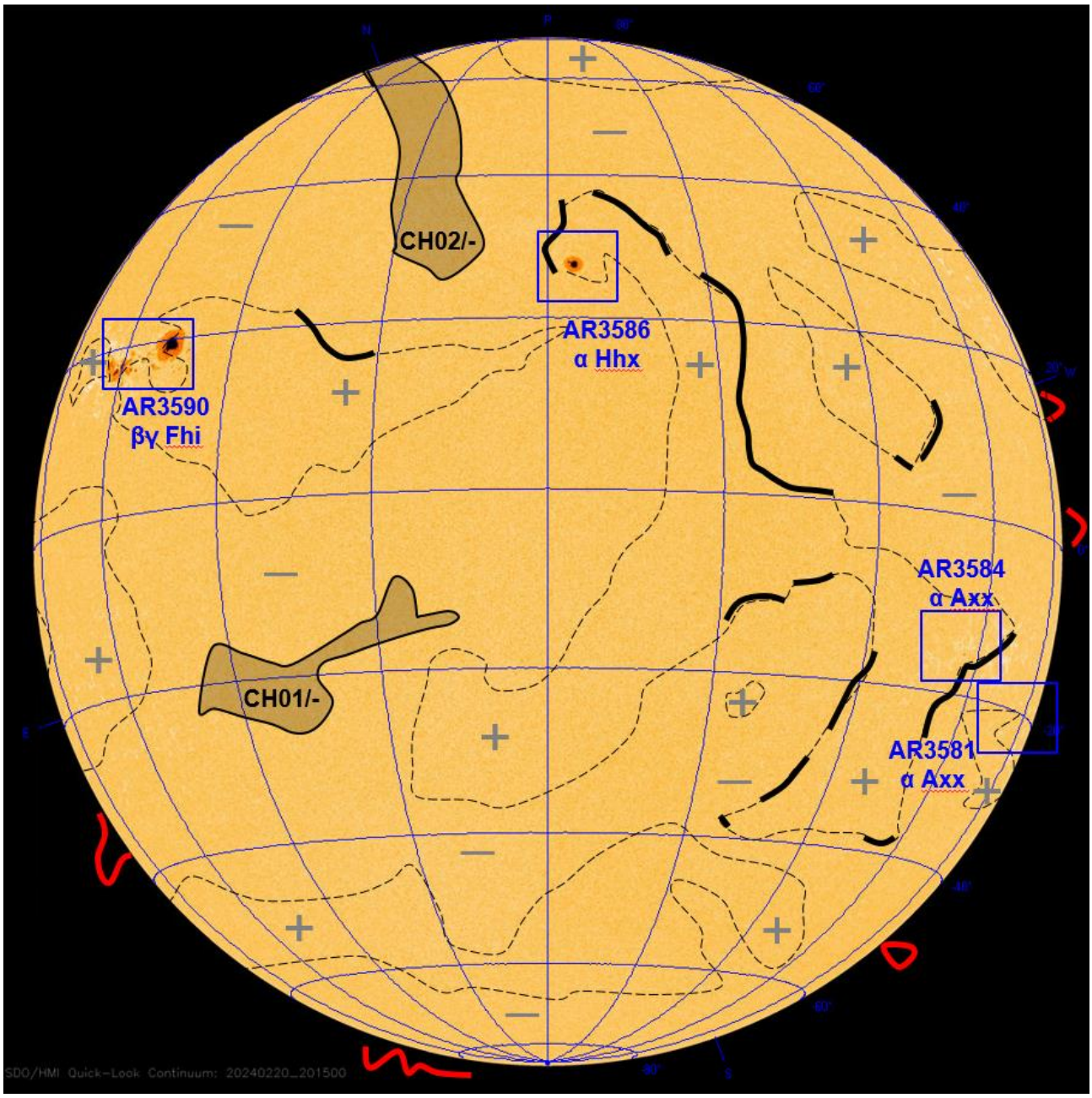
Figure 1. Solar Analysis Valid 20/2000UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

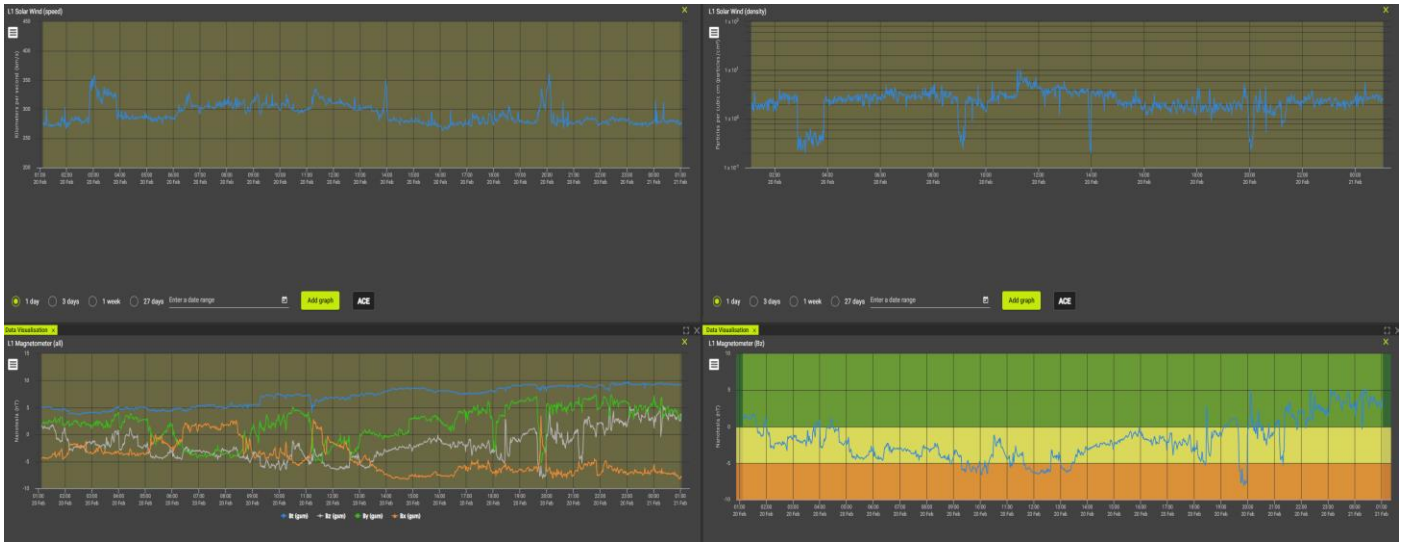
No Earth-directed CMEs are forecast over the next four days.

Solar winds are at ambient levels in a background solar wind environment. No coronal hole high speed streams are expected to affect the Earth through much of the forecast period, with coronal hole 01 potentially connecting with Earth late on 24 February, based on an estimated speed of 500km/s. The high speed stream reached close to 500km/s from the equivalent feature on the last rotation, however there was only a limited geomagnetic response and the feature is smaller on this occasion.

Geomagnetic activity is forecast to be mainly Quiet to Unsettled, with a slight chance of Active late on 24 February. There is only a very slight chance of G1/Minor Storms.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	1	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: Solar wind observations from ACE at L1



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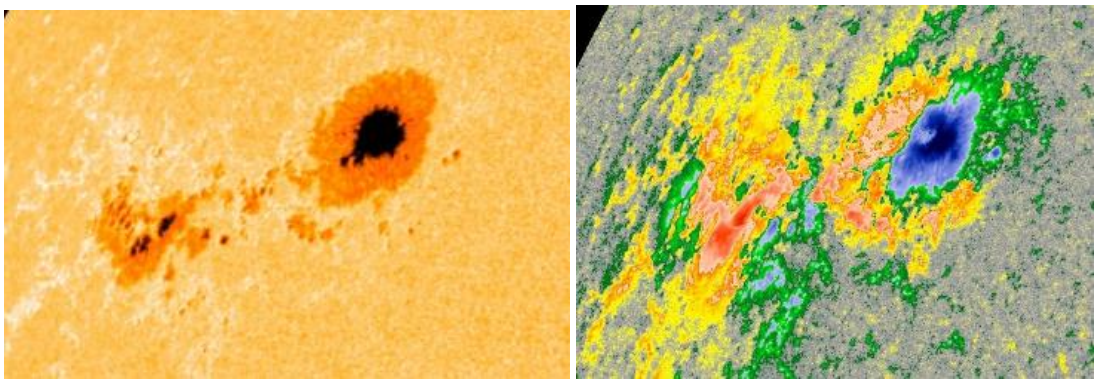
Radio Blackouts - X-Ray Flares:
AR3590 is the largest and most complex region on the visible disc. This is continuing to reveal increasing complexity as it rotates into a more visible location, with foreshortening currently inhibiting a detailed analysis of the magnetic structure. This is the most active region on the disc, but currently is only producing mid-range C-class flaring. The remaining three regions are all stable or weak alpha regions. AR3576 is just beyond the limb, but any significant flares could still be visible for the next two days.

Low solar activity is forecast, with a chance of M-class flares, predominantly from AR3590. The probability values represent the risk presented by this region as it rotates further onto the disc.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	35	35	35	35
Very Active	R3 to R5 X Class	No	5	5	5	5

Figure 3: AR3580 (Fhi/βγ) in the northeast quadrant. Foreshortening due to the position in the disc is complicating analysis of the magnetic field.



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Solar Radiation Storms - (High Energy Protons):

GOES18 high energy (greater than 10MeV) protons are continuing to edge towards background levels, but currently remain slightly elevated above normal background.

Ex-AR3576 will give a decreasing risk of proton enhancements as it was assessed as being complex as it rotated across the western limb. AR3590, despite the large and complex arrangement is not currently considered to present a proton risk, but this risk will increase as it approaches centre disc. The risk of proton storms therefore is likely to decrease through the next four days.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	2	2	1	1
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) is expected to remain at background to moderate levels throughout the period, with so significant inputs from the solar wind currently forecast. Electron fluence is expected to remain well below the Active (1e8 integrated pfu) threshold.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ 2 MeV ≥ $1x10^8$	No	1	1	1	1
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

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